TESTIMONY OF
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Mr. Chairman and Members of the Subcommittee, my name is David Baldwin. I am Senior Vice President and head of the Energy Group of General Atomics in San Diego. Thank you for the opportunity to talk to you today about Generation IV reactors and the important role they can play in a forward looking and comprehensive energy plan.

This year is General Atomics' 50th anniversary. As you might guess from our name, our roots are deeply embedded in nuclear technology. After the first Geneva Convention on the Peaceful Uses of the Atom, GA was created to harness the atom for peaceful commercial purposes. From the very beginning, GA has taken a different road to reactor development. Our approach was first to adopt a reactor concept that could be made inherently safe by laws of physics, then to make it economically competitive and finally to apply it to other national and commercial needs.

As you are probably aware, today's commercial light water reactors are an outgrowth of the U.S. Navy's nuclear reactor program. Those reactors are relatively small, have high power density and are capable of fitting into the limited space available on a ship. Today's LWR cores are relative small, have a high power density and are well proven to be robust and safe in operation. However, their efficiency is limited to approximately 30%, they operate at relatively low temperature, which is a negative for applications like hydrogen production, and they require multi-layered and costly active safety systems.

Today's existing fleet of 103 reactors in the U.S. is without a doubt one of the most safe and reliable assets on our electric grid and we applaud the federal government and U.S. utilities in their collaboration to bring about their simpler and more economic progeny under the Nuclear Power 2010 program. This is a very important step toward a brighter energy future for the U.S.

The next close behind step however must be the introduction of so-called Generation IV reactors. Gen IV reactors now under development promise even better efficiency and economics, improved safety and proliferation resistance and increased versatility. Of the six Gen IV concepts accepted for international study, only one type meets all of these criteria and has had significant industrial experience and history and is essentially ready to be built today. This type of reactor employs helium as the coolant and uses graphite as its moderator.

High Temperature Gas Reactors (HTGRs) operate at sufficient temperature to enable efficient thermo-chemical or high temperature hydrolysis hydrogen production and efficient electric power generation. The core of the HTGR is based on several gas reactors that operated in the 1970s, and the Japanese 30 MW HTTR that is operating today. Based on the ongoing Japanese success and the success of the earlier U.S. versions, we can conclude that the technology of the HTGR core is well in hand and poses little technological risk.

Importantly, the MHR also is versatile in the type of nuclear fuel that it can burn. In fact, high temperature gas reactors are, I believe, unique in their ability to burn almost any type of fissionable material including uranium at nearly any enrichment level, a thorium / uranium mixture, weapons plutonium and as I discuss below, the most toxic and long-lived components of nuclear waste.

IT'S TIME TO BUILD A GEN IV REACTOR

Importantly, from the technological point of view, a demonstration of a commercial scale HTGR is ready to be built today. Indeed, several other countries including France, South Africa, Korea, and China are seriously considering such a demonstration in the very near term. So, the question is whether it is worth it to our country to move ahead and build one or to wait and possibly let another country do it.

As the Members of the Subcommittee are no doubt aware, the construction of a Gen IV reactor for the purpose of electric power and hydrogen production is authorized in H.R. 6, the energy policy bill now before Congress. Timely and successful completion of this project would yield huge dividends to the U.S. in the following areas:

1. **DEMONSTRATION OF IMPROVED SAFETY, SECURITY AND EFFICIENCY -** If the U.S. is going to begin building new nuclear power plants in any significant numbers in order to have an impact on national energy security and improve air quality, then the nuclear plants we build should be the best we can achieve at any given time. Because of their higher operating temperatures, HTGRs are expected to be nearly 50% more efficient in producing electricity than the existing generation of reactors and have the additional benefit of being able to produce hydrogen much more efficiently also. This of course means about 30% less nuclear waste per unit of useful energy and about 30% less cooling water and less waste heat rejected into the environment. These characteristics are in addition to the increased safety and security that is brought on by a reactor design that is built underground and is, by the basic laws of physics, melt-down proof.

2. **DEMONSTRATION OF EFFICIENT NUCLEAR HYDROGEN PRODUCTION –** Without ever even assuming a so-called hydrogen economy, there is a substantial and rapidly growing demand for hydrogen in the U.S. Currently, together, the refinery and fertilizer industries in the U.S. use the hydrogen energy equivalent of about 50 large nuclear power plants. This usage grows at approximately 10 percent per year. At present, this hydrogen is primarily derived from natural gas. This, of course, further drives up the cost of natural gas and makes our industry less competitive and less likely to stay in the U.S. Indeed, we are told that many fertilizer production facilities have

moved out of the U.S. primarily on the basis of the high cost of natural gas. Efficient nuclear production of hydrogen promises competitive and stable prices for hydrogen.

3. **DEMONSTRATION OF A TECHNOLOGY TO BURN UP NUCLEAR WASTE** - There has been much discussion lately about getting the U.S. back into the reprocessing of spent reactor fuel as a means lessening pressure on Yucca Mountain. It is very important to remember however that reprocessing by itself does not get rid of any nuclear waste: it merely separates some of the components of nuclear waste as a first step to facilitate either recycling or waste treatment. One of the great strengths of high temperature gas cooled reactors is, as I've stated, their versatility in burning different types of nuclear fuel including the most toxic and long-lived components of nuclear waste. In fairness, I must mention the fact that certain other reactor designs, including some fast spectrum reactors can also burn these wastes and those capabilities should also be explored. However, work being done at GA, Argonne and other national labs is now confirming that HTGRs are uniquely capable of achieving a deep burn up of nuclear waste actinides, especially Plutonium 239, in a simple once-through fuel cycle without multiple reprocessing and recycling steps. Indeed, we believe that a reasonable growth scenario for gas cooled reactors fueled with nuclear waste actinides would reduce the amount of high-level waste from nuclear power generation to the point that the capacity of Yucca Mountain would meet projected national storage needs for several decades, rather than the 5-10 years under present disposition policy. A demonstration HTGR in the U.S. would provide an ideal test bed for research and development into this means of recycling and destroying spent fuel transuranics, and paving the say to profoundly addressing our nuclear waste disposal issues.

4. **NON-PROLIFERATION BENEFITS –** There are two primary non-proliferation benefits to the U.S. for taking a leadership role in the development of a Gen IV reactor: development of an even more proliferation resistant reactor for export and the rebuilding of the U.S. nuclear industry. For the government to be able to offer other nations with nuclear energy ambitions an extremely proliferation resistant reactor and associated fuel is an important step. Similarly, rebuilding the U.S. owned nuclear industry is extremely important to the implementation of our non-proliferation strategy around the world. Industry is an important set of eyes and ears around the world and can help keep close tabs on the flow and control of nuclear materials. This is "turf" of U.S. national strategic importance that should not be given up lightly to foreign owned industry.

5. REVITALIZE U.S. NUCLEAR RESEARCH AND EDUCATION - It is well known that the number of operating research reactors in the U.S. has continued to decline at a serious rate in the U.S. In addition, the lack of any new nuclear plant construction for over two decades has lessened the incentives for new students to enter into the nuclear arena. The construction of a Gen IV reactor in the U.S. will not only provide a plethora of research opportunities for our national labs and universities, but it will most certainly provide the type of signal to the best and brightest of our students to enter into the nuclear field.

6. U.S. BALANCE OF TRADE AND COMPETITIVENESS - At the most basic level, if Gen IV reactors are indeed the wave of the future, and if the world is going to rely increasingly on nuclear energy, then the U.S. would certainly be better off as an exporter than an importer. At present however, the U.S. owned nuclear technology and supply industry is in almost an extreme state of atrophy. The construction of a Gen IV reactor in the U.S. can be the lynchpin of reviving the U.S. nuclear industry and U.S. nuclear competitiveness in the world. To make this possible, the U.S. government must enter into strategic partnerships with industry, much as it does with renewable energy or clean coal projects and much as every other nuclear nation does with its own industry. As in these other areas, U.S. industry will simply not mount a Gen IV nuclear project without federal leadership.

In summary, there are indeed several types of Gen IV reactors, each of which has its virtues and attributes. Research on all of them should be pursued at some appropriate level. However, only the high temperature gas cooled reactor is technologically ready to move forward today, enjoys the interest of a number of U.S. utilities, is capable of a deep destruction of nuclear waste actinides in a "once-through" cycle, and is the focus of a substantial amount of development in nearly every major nation involved in nuclear energy.

Gen IV reactor research by itself is valuable but does not contribute to energy security in the near- or even medium term. Something must be built and high temperature gas cooled reactors are ready to go. The U.S. has a choice now to either lead or follow in their demonstration and commercialization. Given the lessons we are learning about the geopolitical and security consequences of being an importer of energy instead of an exporter, the correct choice seems obvious.

The so called "Next Generation Nuclear Plant" or NGNP project that is authorized in both the House and Senate versions of H.R. 6 is a historic opportunity to regain U.S. leadership in nuclear energy technology and help bring about a more secure and environmentally sound energy future. So, if one of the key questions being raised during this hearing is "What can the Federal government do to promote Gen IV reactor technology?", the answer is: build the NGNP project as soon as possible.

Thank you for this opportunity to testify.